Influence of Deep-Rooted Vegetation Environments on Climate Predictability

Praveen Kumar[1] (PI) and **Xin-Zhong Liang**[2] (Co-I), [1]Professor, Department of Civil and Environmental Engineering; [2]Research Scientist, Illinois State Water Survey; University of Illinois, Urbana, Illinois 61822

NOAA (GAPP) program Year 2007-2008 Annual
(NOAA grant # NA06OAR4310053)

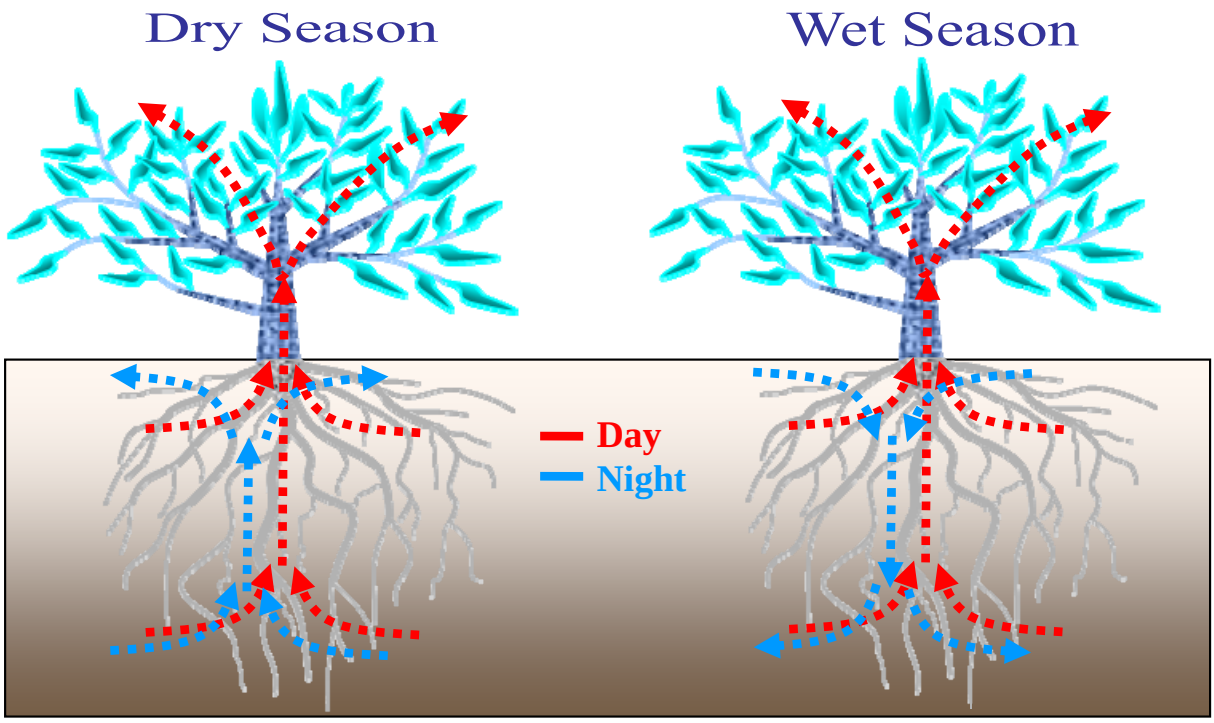

Figure 1: Schematic description of the hydraulic redistribution. The dotted arrows indicate water movement through the root system.

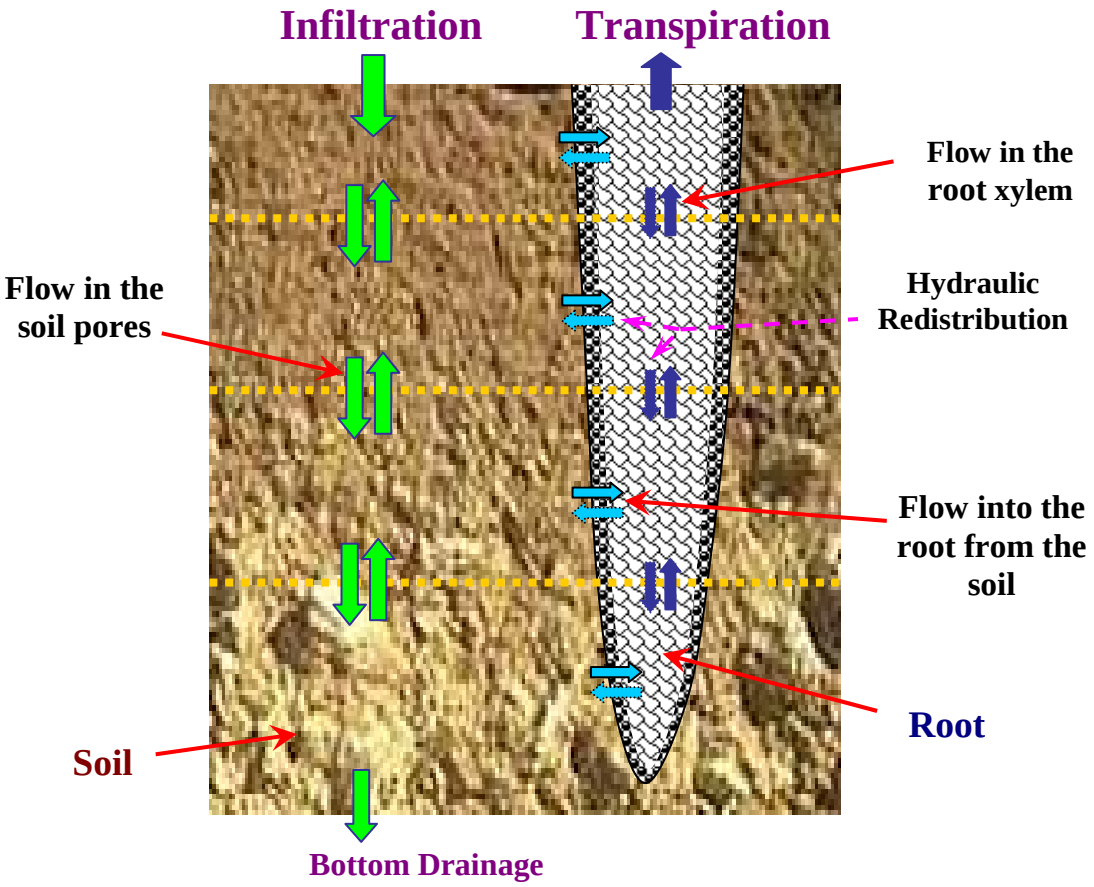

Figure 2: Conceptual view of the hydraulic redistribution model. The water can move in and out of the root system depending on the potential gradient between the soil and the root, where the later is determined by the transpiration demand.

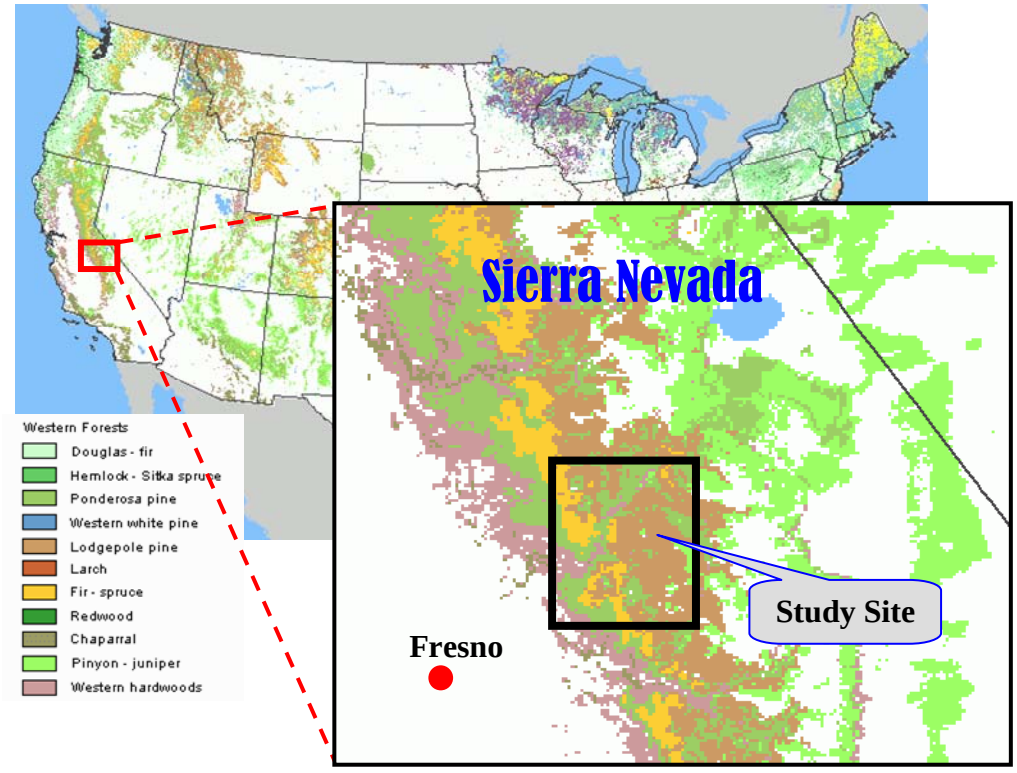

Figure 3: Location and forest cover of the Sierra Nevada study site. (Source: http://nationalatlas.gov/)

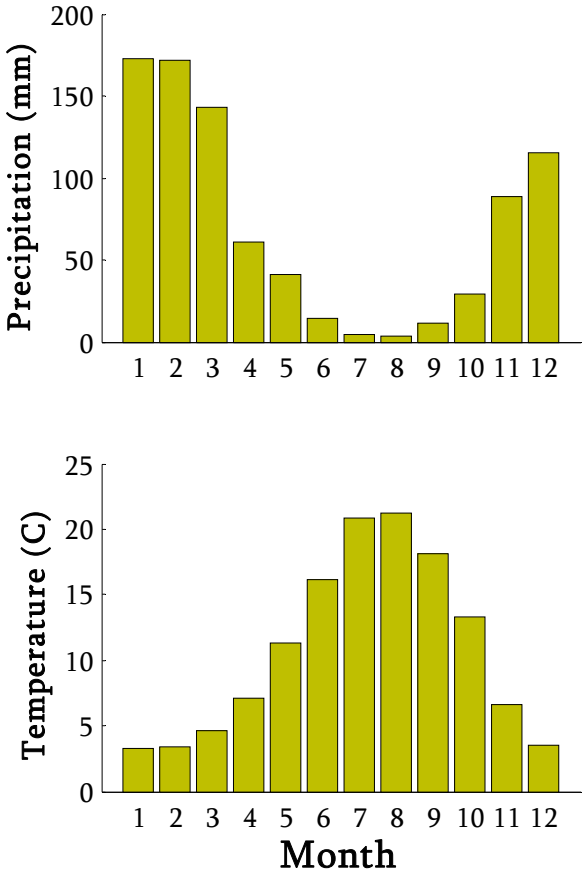

Figure 4: Seasonality of precipitation (top) and temperature (bottom) at the Sierra Nevada study site as obtained from North American Regional Reanalysis (NARR) dataset.

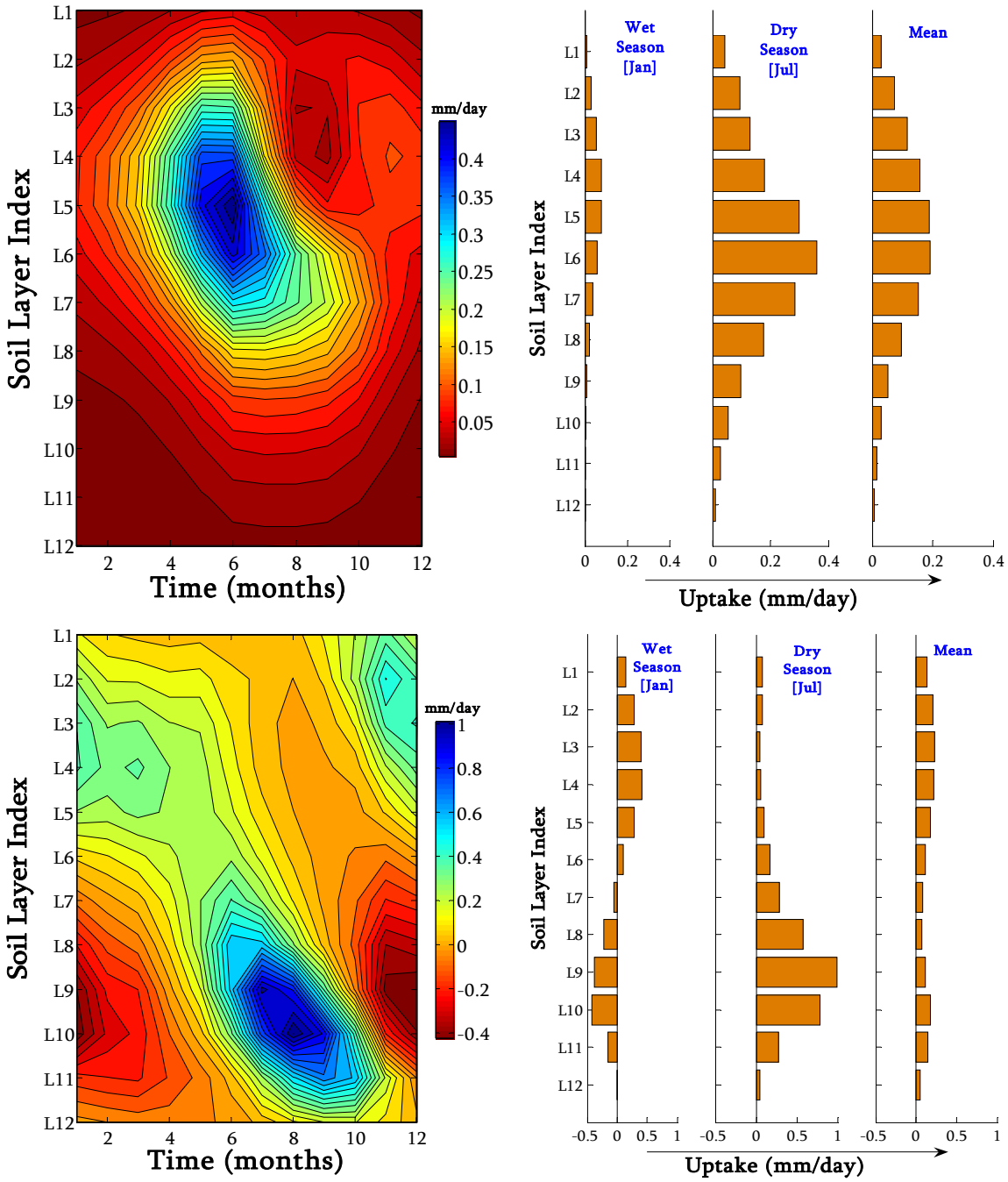

Figure 5: Seasonal profiles of moisture uptake by plant roots for the study site: (top) without hydraulic redistribution, and (bottom) with hydraulic redistribution. The figures show the average over the entire simulation period [1979-2005]. The total depth of the soil layers is 10m. In the lower figure, during the wet season the water is moved downward (negative uptake) and this water is then available for transpiration during the dry season. The hydraulic redistribution, therefore, enables uniform utilization of moisture through the entire soil column. The upper figure depicts the traditional water uptake patterns determined by the root distribution profile currently used in climate models.

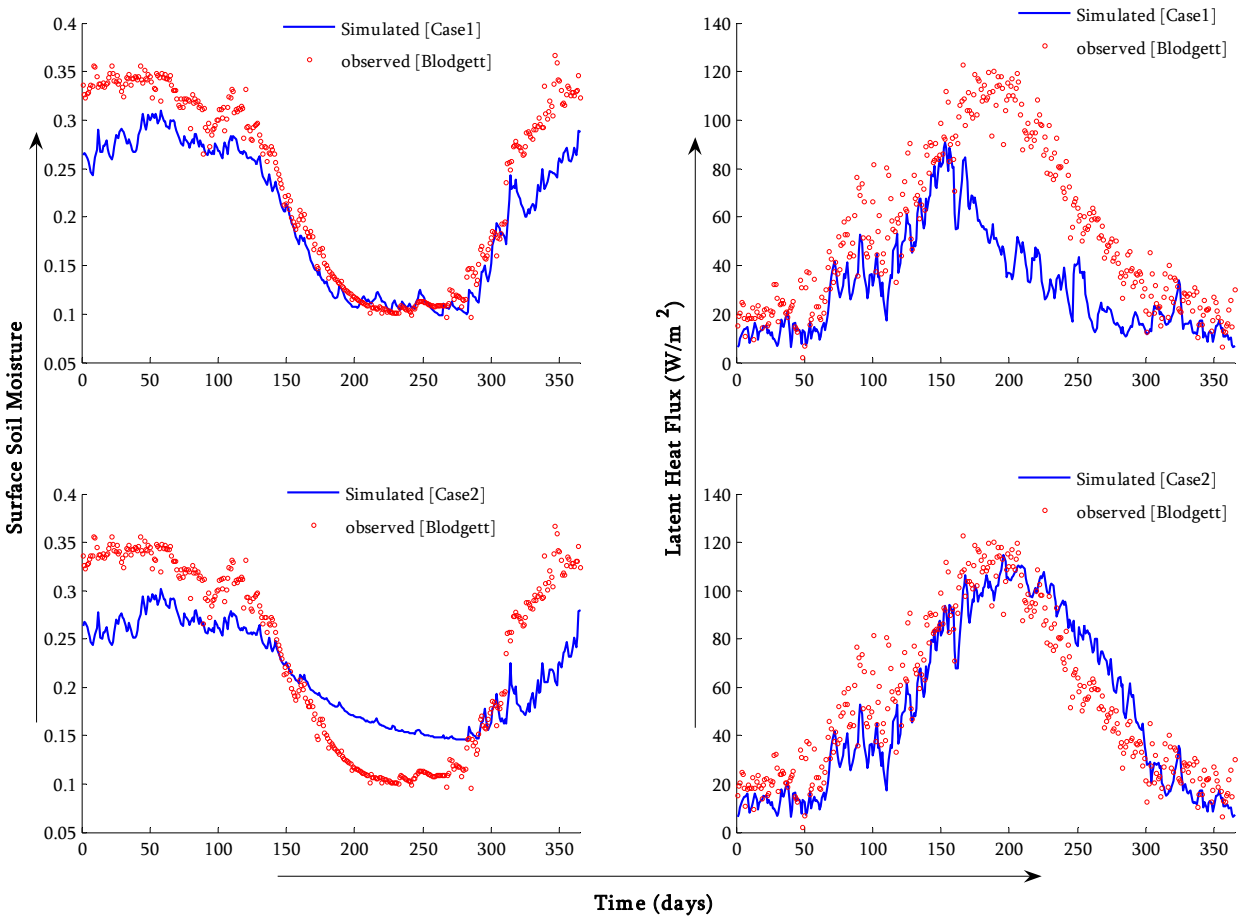

Figure 6: Comparison of simulated and observed soil moisture (left) and latent heat flux (right) for the study site with (bottom) and without (top) hydraulic redistribution. The observation is from the nearby FLUXNET station, Blodgett station and the results depict the average over the observation period from 1999 to 2005. Note the ability of deep root hydraulic redistribution to support transpiration demand during the late summer season (lower right).